#3

Covering arrangement for a building, and covering part for use in such a covering arrangement

The present invention relates to a covering arrangement for a building, the arrangement having parallel elongate supports and, arranged on the supports, covering parts which

a) comprise a core and, connected thereto, upper and lower planar covering elements in the manner of a sandwich,

b) have an elongate, striplike form,

c) in the installed position are arranged transversely to the supports and extend at least from one support to a neighbouring support.

The subject matter of the present invention is also a covering part for use in such a covering arrangement, which

a) comprises a core and, connected thereto, upper and lower planar covering elements in the manner of a sandwich and

b) has an elongate, striplike form.

A covering arrangement of the type mentioned at the outset is known on the market. The covering parts used are sandwich elements with metal covering panels which are spaced apart from each other and between which a thermal insulating material is arranged. The known covering parts are used, for example, as façade elements or for roof coverings. The covering parts are fastened to the underlying supports by a screwed connection. This has the disadvantage that when such a screwed connection fails, due to corrosion for example, the known covering part may become detached at one border, which increases the contact

surface for the wind and may possibly result in the known covering part being torn off, for example in a storm.

The object of the present invention is therefore to develop a covering arrangement of the type mentioned at the outset in such a way that its life is as long as possible and detachment of the covering parts from the supports is reliably prevented even in a storm.

This object is achieved in that

d) a longitudinal border region of a covering part has a connecting device and the opposite longitudinal border region of a neighbouring covering part has a connecting device complementary thereto, by means of which the two covering parts are firmly connected to each other.

Such a connection of the covering parts to one another prevents the possibility, in the event of a failure of the fastening to the supports, of individual covering parts being lifted by a wind load and eventually being torn off completely. This is advantageous particularly in the case of very light sandwich elements which have, for example, only a sheet or a surface coating as covering elements and which could be particularly easily lifted by a gust of wind owing to their low mass.

An advantageous development of the covering arrangement according to the invention is specified in claim 2, according to which the covering arrangement is a roof and the supports are the rafters of a roof.

The object of the present invention is also to develop a covering part of the type mentioned at the outset in such a way that it can be produced inexpensively and connected in

a storm-proof manner to a substructure. This object is achieved in that

c) its one longitudinal border region has a connecting device and its opposite longitudinal border region has a connecting device complementary thereto, such that the covering part can be firmly connected to an identical covering part at, in the installed position, mutually facing longitudinal border regions.

Advantageous developments of such a covering part are specified in claims 4 to 12.

A connecting device which is simple to produce and, moreover, is simple to handle during the production of the covering arrangement according to the invention is specified in claim 4. According to this, the connecting devices comprise at least one catch projection and a catch recess complementary thereto.

It is also advantageous when, as specified in claim 5, the two connecting devices in the installed position cooperate in the manner of a hinge, the pivot axis running substantially parallel to the longitudinal axis of the covering part. In this way, building surfaces, in particular roofs, sections of which have different relative angular positions can be realised.

The stability of the covering part according to the invention is increased by the development as claimed in claim 6, according to which at least one of the connecting devices is integrated into a stiffening member arranged in the region of the corresponding longitudinal border region of said covering part.

A high security of connection is achieved when the connecting devices each extend over the entire length (claim 7).

The development of the invention specified in claim 8, in which the connecting devices are designed in such a way that, in the installed position, the mutually facing longitudinal border regions of neighbouring covering parts overlap, is visually favourable and important for a good seal between two covering parts according to the invention. The seal created by this means is further improved by the developments specified in claims 9 and 10, according to which one of the longitudinal borders of the covering part is drawn down and up, respectively.

According to the development of the invention as claimed in claim 11, at least one of the connecting devices has a plurality of connecting positions, such that the relative position of the covering part with respect to a neighbouring covering part can be varied. This has the advantage that different dimensions of a building surface can be covered in a simple way with identical covering parts without having to cut the covering parts to size.

The connecting device can, as claimed in claim 12, also be used for connection to a snow fence and/or a ladder and/or steps and/or a flashing.

Several exemplary embodiments of the invention will be explained in detail below with reference to the accompanying drawing, in which:

Figure 1 shows a perspective representation of a first exemplary embodiment of a covering arrangement for a building;

Figure 2 shows a partial section in the plane defined by the lines IIa-IIa and IIb-IIb of Figure 1;

Figure 3 shows a detail view III of Figure 2;

Figure 4 shows a representation similar to Figure 3 of a second exemplary embodiment of a covering arrangement;

Figure 5 shows a view similar to Figure 3 of a third exemplary embodiment of a covering arrangement;

Figure 6 shows a section through a covering element and a supporting element at a first point in time during the production of a covering part;

Figure 7 shows the covering element and the supporting element of Figure 6 at a second point in time during the process for the production of the covering part of Figure 6; and

Figure 8 shows the covering element and the supporting element of Figure 6 at a third point in time during the process for the production of the covering part of Figure 6.

In Figure 1 a covering arrangement for a building bears the reference numeral 10 as a whole. The covering arrangement 10 in the present case is a building roof which has, as the parallel elongate supports, rafters 14 and covering parts 16 arranged thereon. In an exemplary embodiment which is not illustrated, the covering arrangement may also be the outside wall of a building.

The covering parts 16 have an elongate, striplike form, are arranged, in the installed position, transversely to the rafters 14 and extend from one gable end to the other gable

end of the roof 10. The roof 10 is a ridge roof with two roof halves 10a and 10b, each extending from a ridge 18 to eaves 20a and 20b, respectively. Arranged between ridge 18 and eaves 20a and 20b, parallel to the course of the ridge 18, are in each case seven identical covering parts 16.

As can be seen from Figure 2, the covering parts 16 each comprise a central section 21 with a core 22 made of polyurethane foam, and also with an upper planar covering element 24 and a lower planar covering element 26, with the result that the central section 21 is constructed in the manner of a sandwich. Both covering elements 24 and 26 consist of a PVC sheet. Arranged between the upper PVC sheet 24 and the core 22 is a supporting element 28 composed of a thin perforated metal sheet (cf. Figure 3), which gives the upper side of the covering part 16 a certain rigidity to impact loads.

Arranged at the, in Figures 2 and 3 left-hand, border region 30 of the covering part 16 is a stiffening member 32 having a rectangular hollow section, whereas in the right-hand border region 34 of the covering part 16 there is provided an open stiffening member 36 forming, as a whole, a right angle. The two stiffening members 32 and 36 are produced from a recycled wood material.

Owing to the fact that the perforated metal sheet 28 arranged beneath the upper PVC sheet is mechanically decoupled from the rigid stiffening members 32 and 36 of the covering part 16, its thermal expansions have no effect on the overall dimensions of the covering part 16. The thermal expansions of the remaining regions of the covering part 16 are very low, since they are produced entirely from plastic and recycled wood material. This reduces possible thermal stresses in the covering part 16 and increases the life thereof. But it also prevents the substructure (i.e.

the rafters 14) from being overloaded and the formation of gaps between neighbouring covering parts 16.

In an exemplary embodiment which is not illustrated, the stiffening members comprise a unidirectional fibre material arranged in the longitudinal direction.

The stiffening member 32 has two webs 38 and 40 (cf. Figure 3) which are perpendicular to the plane of the covering part 16 and connected to each other by flanges 42 and 44 parallel to the plane of the central section 21. The webs 38 and 40 are approximately twice as high as the thickness of the central section 21 (or the distance between the PVC sheets 24 and 26). The lower flange 44 lies approximately in the plane of the lower PVC sheet 26, which is welded to its outside. A strap 46 pointing away from the central region is integrally formed on the lower flange 44. The strap 46 is screwed to the respective rafter 14 by a screw 48, illustrated merely by a dot-dash line in Figures 2 and 3, and via an angle-compensating wedge 50.

The upper flange 42 of the stiffening member 32 has an extension 52 which extends parallel to the plane of the central section 21 and towards the latter. A connecting section 54, running substantially downwards in Figures 2 and 3, the free edge 55 of which is curved towards the central section 21, is integrally formed on the free edge of the extension 52. The upper PVC sheet 24 is welded to the side of the connecting section 54 facing the web 40 of the stiffening member 32. Integrally formed on the outside of the right-hand web 40 is a clamping strip 56 which points obliquely upwards towards the connecting section 54 or the upper extension 52 and between the tapering edge 57 of which and the connecting section 54 the upper PVC sheet 24 is additionally clamped.

The stiffening member 36 in the right-hand border region 34 of the covering part 16 is constructed as follows: it comprises a straight base section 58 which is oriented substantially parallel to the plane of the central section 21 of the covering part 16 and welded, in its left-hand border region, to the lower PVC sheet 26 of the covering part 16, whereas its border region on the right in Figures 2 and 3 is integrally connected to a connecting section 60 perpendicular to the plane of the central section 21 of the covering part 16 and extending downwards in the installed position shown in Figure 3. The outside of the connecting section 60 is welded to the border of the upper PVC sheet 24 of the covering part 16, such that the right-hand border region 34 of the covering element 16 has a bend 61 angled downwards, as a whole, by 90° from the plane of the central section 21.

On the base section 58 of the stiffening member 36 there is, furthermore, integrally formed an extension 62 which runs parallel to the connecting section 60 and is spaced somewhat therefrom. A clamping strip 64 having a tapering edge 63 extends from the extension 62 towards the connecting section 60, such that the border of the upper PVC sheet 24 is clamped between the edge 63 of the clamping strip 64 and the surface of the connecting section 60 lying opposite thereto. On the base section 58 there are, furthermore, integrally formed, towards the core 22 of the covering part 16, obliquely protruding anchoring elements 66 which ensure secure anchorage of the stiffening member 36 in the core 22.

As a result of the said design and arrangement of the stiffening member 32, the left-hand border region 30 of the covering part 16 is drawn upwards by about 90°. The right-hand border region 34 of the covering part 16 is, in contrast, drawn downwards, as a whole, by about 90° by the bend 61. In the installed position illustrated in Figures 2

and 3, two neighbouring covering parts 16 are arranged in such a way that these end regions 30 and 34 overlap and engage behind each other.

The webs 38 and 40 of the stiffening member 32 which run perpendicular to the planes of the covering parts 16, and the connecting section 60 which likewise runs perpendicular to the plane of the covering part 16, and the extension 62 of the stiffening member 36 give the covering part 16 the necessary flexural strength for the operating loads (snow, wind, etc.) to be expected, which the extremely light, but not very rigid composite structure composed of upper PVC sheet 24, lower PVC sheet 26 and core 22 would lack on its own.

The two stiffening members 32 and 36 each have mutually complementary connecting devices 68 and 70, by which the opposite border regions 30 and 34 of neighbouring covering parts 16 can be connected to each another. The connecting device 68 provided on the stiffening member 32 consists of three cylindrical and mutually identical catch recesses 72, 74 and 76 which are formed one beside the other in the upper side of the upper flange 42 and run in the longitudinal direction of the stiffening member 32. The connecting device 70 of the stiffening member 36 consists of a cylindrical catch protuberance 78 which is complementary to each of the catch recesses 72, 74, 76, likewise extends in the longitudinal direction of the stiffening member 36 and is integrally formed on the base section 58 via a connecting web 80 perpendicular to the base section 58 of the stiffening member 36.

The opening width of the catch recesses 72, 74 and 76 and the width of the connecting web 80 of the catch protuberance 78 are coordinated with each other in such a way that the covering part 16 at the top in Figures 2 and 3 can be tilted in the manner of a hinge with respect to the

corresponding lower covering part 16 in a certain angular range about the longitudinal axis of the catch protuberance 78 and of the corresponding catch recess 72, 74 and 76. In this way, roof surfaces with sections of different inclination can be realised. The dimensions of the stiffening members 32 and 36, and also of the connecting devices 68 and 70, are in this case coordinated with each other in such a way that, in the installed position, a gap is present between the stiffening members 32 and 36 and in particular between the connecting section 60 of the stiffening member 36 and the connecting section 54 of the stiffening member 32, the function of which gap will be discussed in more detail hereinbelow.

By providing three catch recesses 73, 74 and 76 running parallel to one another, it is possible to vary the relative position of a covering part 16 with respect to a neighbouring covering part 16 and thereby cover any roof sizes with identical covering parts 16 without one or more covering parts 16 having to be cut to size accordingly. This can be seen particularly well from Figure 2: the covering parts 16 illustrated in this figure are all in different relative positions to the respectively neighbouring covering part 16.

In an exemplary embodiment which is not illustrated, instead of the catch protuberances and catch recesses hooks curved in the shape of a quarter circle and correspondingly shaped recesses may be employed, ensuring a more secure connection of neighbouring covering parts.

The mutual connection of neighbouring covering parts 16 prevents the wind from getting under a lightweight covering part 16 and tearing it off. In this way, a storm-proof roof-covering arrangement 10 is created. The penetration of snow and moisture is also effectively prevented.

Integrally formed on the base section 58 of the stiffening member 36, parallel to the connecting web 80, is a clamping web 82 which likewise extends over the entire length of the stiffening member 36. The position, width and length of the clamping web 82 are dimensioned in such a way that, in the installed position illustrated in Figure 3, in which the catch protuberance 78 of the stiffening member 36 is caught in the catch recess 72 of the stiffening member 32 furthest to the left, it penetrates into the middle catch recess 74, while leaving a free space between the clamping web 82 and the wall of the middle catch recess 74.

In this way, it is possible to pass a flashing, not illustrated in the drawing, for example of a skylight, a lead-in for a satellite dish, etc., through the gap between the two connecting sections 54 and 60 and to clamp it between the clamping web 82 and the middle catch recess 74. An absolutely moisture-tight connection of such a flashing to the covering parts 16 is thus ensured in a simple way.

The covering part 16 illustrated in Figure 3 is produced as follows:

First of all, the upper PVC sheet 24, which is in the form of a continuous material, is welded to the supporting element 28, which is likewise in the form of a continuous material. This is illustrated in Figure 6.

Then, the composite structure composed of upper PVC sheet 24 and supporting element 28 is plastically deformed by a roll, thereby creating the desired surface structure. This may, for example, be the surface structure of a plain tile pattern or of a clinker brick, etc. The result of this step is illustrated in Figure 7.

Now, the stiffening members 32 and 34 (not illustrated in Figures 6 to 8) are likewise produced as continuous parts

and the longitudinal borders of the PVC sheets 24 and 26 are connected to the stiffening members 32 and 36 in a continuous process. This may be effected, for example, by pushing the borders of the PVC sheets 24 and 26 in between the clamping strips 56 and 64, respectively, and the connecting section 54 and 60, respectively, with the aid of a press-roll or, for example, using compressed air. To achieve optimal retention, the PVC sheets 24 and 26 are additionally welded to the stiffening members 32 and 36 as well.

Subsequently, the PU foam of the core 22 is introduced into the hollow space created between the two PVC sheets 24 and 26 and the two stiffening members 32 and 36. The composite structure composed of the two PVC sheets 24 and 26, the two stiffening members 32 and 36 and the still warm and thus soft PU core 22 is now passed through a die (not illustrated in the figure) corresponding to the desired cross-section of the covering part 16 and cooled in the process. In this way, the desired covering part 16 is produced in a continuous process (cf. Figure 8).

A second exemplary embodiment of a covering part 16 is illustrated in Figure 4. Parts which are functionally equivalent to those parts already described in connection with the first exemplary embodiment bear the same reference numerals and are not explained in detail here once again.

An essential difference to the previous exemplary embodiment concerns the connection of the upper PVC sheet 24 to the respective stiffening members 32 and 36: welding is completely dispensed with here. This may be useful, for example, when the stiffening members 32 and 36 are made of a material (e.g. certain metals) to which the PVC sheet 24 cannot be readily welded. The lower PVC sheet 26, which is less heavily exposed to environmental loading, is adhesively bonded to the stiffening members 32

and 36 in the present case. Alternatively, it could also be vulcanised on. In the case of the stiffening member 32, therefore, the right-hand web 40 and the connecting section 54 each have at the same height a catch projection 84 and 86, respectively, which run in the longitudinal direction of the stiffening member 32 and behind which a catch spring 88, likewise extending over the entire length of the stiffening member 32, is clamped.

The border of the PVC sheet 24 is clamped between the catch spring 88 and the catch projections 84 and 86 and thereby fixed to the stiffening member 32. Analogously to this, in the connecting section 60 and the extension 62 of the stiffening member 36 there is formed in each case a catch projection 90 and 92, respectively, behind which a catch spring 94 is clamped, thereby firmly connecting the upper PVC sheet 24 to the stiffening member 36.

Furthermore, the stiffening member 36 has two rectangular hollow sections 96 and 98, on which the likewise hollow catch protuberance 78 is integrally formed. Furthermore, the anchoring elements 66, by means of which a secure connection of the stiffening member 36 to the core 22 is produced, are of T-shaped design. Finally, in the upper flange 42 of the stiffening member 32 there is provided a hollow space 100, likewise extending in the longitudinal direction. The design of the stiffening member 36 with the two hollow sections 96 and 98 leads to a weight reduction while at the same time providing high rigidity. The same applies to the hollow space 100 in the stiffening member 32.

Also illustrated in Figure 4 is an additional element 102 which is passed through the interspace between the border regions 30 and 34 of the two covering parts 16 with its border region and is hung into the catch recess 76, free in Figure 4, of the stiffening member 32 with a bent border

section 104. The additional element 102 may, for example, be a snow fence, a ladder or steps. In this way, such an additional element 102 can be fastened in a simple way without the need for openings through the covering part 16.

A third exemplary embodiment of a covering part 16 is illustrated in Figure 5. Here, too, parts which are functionally equivalent to those parts of the previous exemplary embodiments bear the same reference numerals and are not explained in detail once again.

The exemplary embodiment of a covering part 16 illustrated in Figure 5 is a simplified embodiment having straight border regions 30 and 34 which are thus not drawn downwards or upwards. The stiffening members 32 and 36 are also of a simpler construction. For example, the stiffening member 32 has no hollow section but only a single web 38. Furthermore, a plurality of side-by-side catch recesses are not provided, but only a single catch recess 72, with the result that the relative position of neighbouring covering parts 16 cannot be varied. Such a covering part 16 is simpler and less expensive to produce.